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Art. XIV.—*Studies on Australian Aquatic Phycomycetes.*

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Introduction.

In recent years, investigations have been carried out in different countries, notably Great Britain, America, Germany, and Denmark, to ascertain the nature of the aquatic fungus flora. The rarer members, Blastocladia, Sapromyces, and Rhipidium were not recorded until late in the nineteenth century, when they were described by Cornu (1871), Reinsch (1878), and Thaxter (1894-1896), although investigations in the Saprolegniaceae had commenced much earlier. Early in the twentieth century accounts of aquatic fungi by Von Minden (1912) in Germany, and Petersen (1910) in Denmark were published, but only occasional records appeared from then until 1922, since when, this group, particularly the rarer families, Blastocladiaceae and Leptomitaceae, has drawn the attention of a number of workers. Recently, Lund (1934) has contributed to the records of the aquatic fungi in Denmark, and Apinis (1929) has investigated the Saprolegniaceae in Latvia. Coker (1922-1926) and his workers thoroughly studied the group in America, followed by other papers—Kanouse (1925, 1927, 1932), Couch (1926, 1927, 1932), Harvey (1930), and Sparrow (1932, 1936). In Great Britain, the earliest records of aquatic fungi were by Massee (1891) and Ramsbottom (1914-1916), but since 1932 other mycologists have contributed to this group, namely Barnes and Melville (1932), Cook and Forbes (1932), Forbes (1935), and just before the completion of this paper Sparrow (1936) published the results of an extensive investigation. Hitherto, in Australia, the attention of workers has been confined to the terrestrial fungus flora, with the exception of records by Rodway (1897), Hardy (1910), and Johnston (1917, 1921) of *Saprolegnia ferax* associated with a disease in fish.

The present writer gives an account of some members of the Blastocladiales and Saprolegniales and compares them with those recorded in other countries. None of the fungi described in this paper, with the exception of *Saprolegnia ferax*, has previously been described from Australia.

The writer was particularly interested in the rarer Blastocladiales and Leptomitaceae, and, when collecting, efforts were made to secure these forms rather than the filamentous fungi—

Saprolegniaceae or Pythiaceae, although the latter were also obtained. The fungi have been collected chiefly from artificial ponds, and, only in three instances, have they been collected from natural waters—Yarra River at Rudder Grange, Barham River at Apollo Bay, and McCallum's Creek near Maryborough.

Methods of Collection.

The methods used were those employed by other workers on this group—i.e., the Blastocladiales and Leptomitaceae—the setting of traps containing suitable baits in a likely locality. The baits used were twigs, rose hips, apples, oranges, bananas, grapes, prunes, *Cotoneaster* berries, *Crataegus* berries, *Solanum pseudocapsicum* berries, and *Japonica* fruits. They were put into fine wire-mesh baskets, which were placed in the pond or stream, anchored to the shore by a long wire, and submerged for one or two months. When the baits were brought into the laboratory, they were thoroughly washed in running water for about a day, and then transferred to sterile distilled water, in glass dishes with loosely fitting covers, so as not to exclude the air. Examination of the baits was commenced immediately. In most cases, the pustules formed by *Blastocladia, Gonapodya, Sapromyces,* and *Rhipidium* were visible when brought in and sometimes the fruits were covered thickly with these whitish patches. Infection of the fruits and further development of the plants, e.g., the formation of resting spores, continued after they were placed in sterile water.

The filamentous fungi, e.g., Saprolegniaceae, which usually occurred on twigs, but also on some fruits, rose hips, and *Crataegus* berries, did not appear for a few days after the baits were brought in. They were then transferred to dishes of sterile water containing boiled halved hemp seeds, on which they grow readily. The descriptions of the forms included in this paper are from the growth on hemp seeds.

In a couple of instances, pond water was brought in to the laboratory, and immediately baited with boiled hemp seeds. After a few days, the filamentous forms, e.g., *Dictyuchus* and *Achlya,* appeared. Pond water was also baited with grapes and prunes, when *Pythiomorpha* was obtained. This genus also appeared on rose hips after they had been in the laboratory for some days. For *Blastocladia, Sapromyces, Rhipidium,* and *Gonapodya,* the satisfactory baits are apples, rose hips, *Crataegus* berries, and *Japonica* fruits. Oranges were used as baits on two occasions but only *Pythiomorpha* was obtained.

Owing to the difficulty of keeping permanent cultures of the Blastocladiales and Leptomitales, plants of these members were mounted on slides in glycerine jelly for reference purposes.

Cultural Methods.

(i) SAPROLEGNIALES.

When the filamentous threads appeared on the bait, they were lifted off, and transferred to dishes of sterile water containing boiled halved hemp seeds. Sometimes mixed cultures were obtained, but as *Saprolegnia, Achlya,* or *Dictyuchus* readily formed sporangia, one of the latter was cut off, transferred to another dish, and thus pure cultures were obtained. Sometimes the sex organs developed readily, e.g., in *Saprolegnia ferax,* but in other cases, difficulty was experienced in obtaining them, as in *Achlya conspicua.* Their development was often very localized —appearing in only one place in a dish containing several hemp seeds.

A species of *Achlya,* also one of *Dictyuchus* (later regarded as *D. sterile,* or one grain of a heterothallic *Dictyuchus*), did not develop sex organs on hemp seed, and attempts were made to obtain them by growing the fungi on hemp seeds in different culture media, also on solid media.

The following media were used:—

(*a*) Agar for Saprolegniaceae (recommended by W. Höhnk 1932)—1 litre distilled water, 8–10 gm. agar, 5 gm. carragen (or if not available 5 gm. agar), 0.5 gm. gm. dextrose, 0.05 gm. citric acid.

Stock solution—0.005 gm. KH_2PO_4, 0.000025 gm. NH_4NO_3, 0.000025 gm. $Mg.SO_4$, 0.000025 gm. $(NH_4)_2SO_4$.

(*b*) Levulose and peptone agar—Levulose 1.2 per cent., peptone 0.1 per cent.

(*c*) Glucose and peptone agar—Glucose 1.2 per cent., peptone, 0.1 per cent., agar 1.5 per cent.

(*d*) Solutions of maltose and peptone in water—1. Maltose and peptone .0125 per cent. each. 2. 0.3 per cent. maltose and 0.1 per cent peptone. 3. 0.05 per cent. maltose and 0.025 per cent. peptone.

(*e*) Solution of Witte's peptone—0.1 per cent., leucin 0.1 per cent., maltose 0.5 per cent.

(*f*) Solution of saccharose—0.025 per cent. in which cubes of egg albumen were placed instead of the hemp seeds.

In all of these good growth was obtained, but no sexual organs. Kanouse (1932) had considerable success with some of these peptone cultures in combination with maltose or glucose, and also with the addition of leucin, in inducing the formation of oogonia and antheridia in *Saprolegnia parasitica*—a form which until then was regarded as sterile; but with these media, the writer could not obtain sex organs in either the *Achlya sp.* or *Dictyuchus*

sp. A method described by Couch (1932) which was very successful with *Leptolegnia candata* was also tried, together with certain modifications of it, by transferring the growth from the maltose and peptone solutions described above, to sterile water. In only one case were oogonia obtained; the *Achlya* growth was transferred from a solution containing 0.025 per cent. maltose and 0.025 per cent. peptone to sterile water, and after three to four days, numerous oogonia appeared, but no antheridia. The oogonia degenerated without the development of eggs.

Experiments were then tried using heteroauxin, a plant growth hormone, and an A–Z solution, a solution containing traces of the rarer elements; in this case 35 were present. The following concentrations were used:—

(*a*) $\frac{1}{100,000}$ heteroauxin in maltose and peptone, 0.025 per cent each.

(*b*) $\frac{1}{50,000}$ heteroauxin in 0.025 per cent. maltose and 0.025 per cent. peptone.

(*c*) $\frac{1}{50,000}$ heteroauxin in 0.025 per cent. saccharose.

(*d*) $\frac{1}{100,000}$ heteroauxin in water.

(*e*) A–Z solution, 2–6 drops in 0.025 per cent. maltose and 0.025 per cent. peptone.

(*f*) A–Z solution, 2–6 drops in 0.025 per cent. saccharose solution.

In all cases, a good vegetative growth was obtained but no sexual organs. When the mycelium was transferred from these solutions to sterile water, oogonia appeared in all cases after a few days, but were most numerous in the solutions of $\frac{1}{50,000}$ heteroauxin. Two antheridia appeared, and, in all cases the oogonia again degenerated after a day or two, suggesting either that the sexuality-inducing substance was not present in sufficient amounts to carry the development farther, or that the plant in question is the female strain of a heterothallic species.

A series of experiments was also carried out, following those of Leonian (1936), an account of which appeared just before the completion of this paper. Using pea-infusion as the sexuality-promoting substance, Leonian obtained considerable success with *Phytophthora cactorum*. However, in the case of *Achlya sp.*, the pea-infusion did not induce the formation of any sexual organs, not even the oogonia obtained in the previous solutions.

It is evident that physiologically each species is extremely specialized, as has been shown in the past by the experiments of different workers, and substances which may induce the formation of oogonia in one species will have no effect in even another species of the genus.

(ii) BLASTOCLADIALES AND LEPTOMITACEAE.

Previous workers have shown the extreme difficulty of obtaining these forms in culture. Coker (1923) has obtained a slow growth of *Sapromyces* in vegetable juices obtained by boiling corn grains or peas, and Von Minden (1916) described a method of growing *Araiospora* and *Rhipidium europaeum* in culture, but all attempts with the Blastocladiales have given negative results. Since these forms grow readily on rose hips, a solid medium was tried in which an extract from rose hips was solidified with agar. An infusion from rose hips was also used, but no growth was obtained.

Slopes of carrot partly covered with water were inoculated with plants of *Blastocladia*, *Sapromyces*, and *Gonapodya*, but gave negative results. A bacterial scum quickly develops, but this is not the only factor prohibiting growth. *Sapromyces* was found to grow slowly in prune juice, but no new plants appeared, showing that neither the zoospores nor resting spores germinated. It is suggested that owing to the extreme sensitivity of the protoplasm in these forms, the mere act of disturbing them by transference from the original substratum, renders them incapable of germination.

Another method was tried, so as to have cultures of these forms for continuous study. It was found that when baits were brought in to the laboratory, pustules were formed in addition to those already present. Fresh apples were added to dishes containing infected apples, in the hope that they would be attacked, but the result was negative. Even when pustules were transferred directly to the fruits no further infection occurred, although the fungi apparently continued to grow. It would appear that, in the lakes or streams in which the traps are placed, bacterial action is responsible for the softening of the fruit surface before fungal attack. Naturally baits brought into the laboratory were washed frequently to keep down bacterial contamination, and it was thought that this may have prevented the apples from being attacked. Sterile tap water was used for washing the baits at first, but later on just ordinary tap water. Another experiment was tried in which fresh apples were placed in dishes with the bait, and the water was not changed. After two months, the apple skin was softened, but no infection had occurred. It is therefore concluded that in lakes, etc., decomposing bacteria and organisms, not found in tap water, prepare the fruit surface for fungal attack.

The fact that these fungi often possess rhizoidal systems should not be wholly responsible for the difficulty in obtaining them in culture, but evidently, parts of plants, e.g., filaments broken off, do not produce new plants as in Saprolegniaceae, Pythiaceae, etc., and the formation of plants must be entirely dependent on the germination of the spores—the protoplasm of which is extremely sensitive to any disturbing forces and to environment.

Description of the Fungi in Culture.

SAPROLEGNIALES. **Saprolegniaceae.**

SAPROLEGNIA FERAX (Gruith.) Thuret.

Ann. Sci. Nat. Bot., Series 3, 14: 214, pl. 22, 1850.

Saprophytic on *Crataegus* fruits at University, collected 5th April, 1935; growth rather coarse on hemp seed; sporangia, terminal, cylindrical, proliferating with an average diameter of 54.5μ, and a great variation in length, often constricted by the mouths of earlier sporangia; gemmae pyriform to oval, and occasionally bearing oogonia, frequently in chains (Fig. 1, B); oogonia spherical to oval, occasionally cylindrical when developed in an empty sporangium, borne in a terminal, lateral, or intercalary position on the hyphae; wall about 1.9μ thick, with conspicuous pits which have a diameter range of 6–10μ, average diameter 7μ; frequently, a narrow hypha is observed to pass into the cavity of the oogonium from the apex of the oogonial stalk; spores—1–30 per oogonium; centric, 18–34μ in diameter, usually 25μ; antheridia found on about 60 per cent. of the oogonia; mainly androgynous but of diclinous origin when the oogonia are borne terminally. When the oogonium arises on a short lateral branch, the antheridium arises from the stalk of the oogonium; antheridia usually slender and branched, but only one or few found on any one oogonium (Fig. 1, D–G).

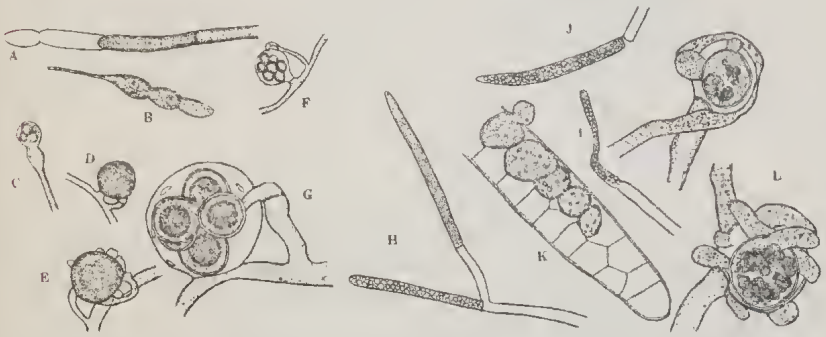

FIG. 1.—A-G, *Saprolegnia ferax* (Gruith) Thuret. H-L, *Dictyuchus monosporus* Leitgeb. A, Sporangia, B, Gemmae, C, Gemma containing eggs, D, E, F, Oogonia and Antheridia. All × 33. G, Oogonium containing mature oospores. × 207. H, I, Sporangia of normal type. × 33. J, Resting sporangium about to fall off. × 33. K, Portion of sporangium showing network. × 207. L, Oogonia with encircling antheridia. × 207.

There has been much discussion as to whether *S. ferax* and *S. mixta* should be regarded as two distinct species. Formerly *S. ferax* was distinguished from *S. mixta*, in possessing antheridia on usually less than 10 per cent. of the oogonia, but it has been found that the same culture may at different times vary in the percentage of oogonia-bearing antheridia. According to Forbes (15), the species formerly known as *S. mixta* is only a growth form of *S. ferax*, and the same applies to *S. monoica*, so that *S. ferax* is regarded as one good species which shows different growth forms under varying environmental conditions. Hence, the form in question, since it possesses antheridia on approximately 60 per cent. of the oogonia, most closely approximates to *S. ferax "forma mixta."*.

ACHLYA CONSPICUA.

Coker in "The Saprolegniaceae," 1923, p. 131.

Saprophytic on *Crataegus* fruits and twigs in lake at University, 5th April, 1935: this fungus has a coarse white growth on hemp seed, the hyphae reaching a diameter of 80μ; sporangia abundant, arising by lateral branching, 90–400μ in length and 18–50μ in breadth (Fig. 2 C); gemmae frequently formed especially in old cultures; they resemble sporangia in shape but are larger, frequently have prongs, giving a forked appearance; oogonia not always developed, but when present are borne laterally on the main hyphae; spherical in shape, 55–80μ diameter; the walls are not very thick but pitted, the diameter of the pits varying from 5.5–7.5μ. Usually 4–10 oospores are developed in a single oogonium but over 20 have been observed in a few cases, ranging in diameter from 21–30μ; eggs rarely mature, but nearly always degenerate immediately and become filled with oil drops. When they do mature, the eggs are sub-centric, smaller droplets surrounding the subcentric larger globule; Antheridia always present, usually androgynous, but occasionally diclinous, arising near the oogonial stalk from the main hypha, or frequently from the oogonial stalks themselves; antheridia are simple or branched, one or sometimes two to each oogonium, usually touching the oogonium by foot-like projections (Fig. 2, D, E).

ACHLYA AMERICANA var.—MEGASPERMA var. nov.

Saprophytic on rose hips, in lake in Fitzroy Gardens, Melbourne, 20th July, 1935; hyphae variable in diameter, but mainly coarse reaching a diameter of 100μ; sporangia tapering towards the tip, usually up to 350μ in length, and about 40μ in the widest part; gemmae few, in chains of 2 or 3 (Fig. 3, E); oogonia are numerous, borne in a racemose fashion along the hyphae; oogonial stalks usually about the same length as the diameter of the oogonium or less than $\frac{1}{2}$, rarely $1\frac{1}{2}$ times the diameter of the oogonia; the latter are occasionally borne terminally on the

hyphae; oogonia spherical, mainly 40–100μ in diameter, walls thin and pitted, the pits usually fairly conspicuous; oospores 24–31μ in diameter, average 27μ, 2–20 per oogonium, usually 6–8, eccentric; antheridia branched, androgynous, but occasionally diclinous, one to four on each oogonium, one antheridium often supplying two oogonia: antheridia usually arise from the main hyphae, occasionally from the oogonial stalk, and are slender, long and branching (Fig. 3, F. G): In the cultures of this fungus, it was found that the eggs frequently disorganized before reaching maturity, leaving the oogonium filled with oily masses.

This species appears to resemble *A. americana* but differs from the description of the type species in the larger size of the oospores, which rang from 24–31μ, average diameter 27μ, as against 18.5–25μ, average 22μ of the latter. Several workers found it impossible to separate *Achlya de Baryana* and *Achlya americana* as two distinct species; but Forbes (1935) distinguishes them as follows:—In *A. de Baryana,* the oogonial walls are unpitted and some diclinous antheridia occur, while in *A. americana,* the oogonial walls are pitted, and the antheridia are consistently androgynous. Coker describes a form referred to *A. americana,* in which the oogonial walls are pitted, but the antheridia may occasionally be diclinous, so that our species, having pitted oogonial walls, occasional diclinous antheridia, the latter sometimes arising from the oogonial stalk, a feature never found in *A. de Baryana,* seems to be a variety of *A. americana.*

Owing to the large size of the oospores, this form is referred to *A. americana* var. *megasperma* var. nov.

Another variety of *A. americana,* namely, *A. americana* var. *cambrica,* possesses characters not found in this species, namely oogonia with thick yellowish walls, and oospores with a very thick two-layered wall, and 23–26μ in diameter.

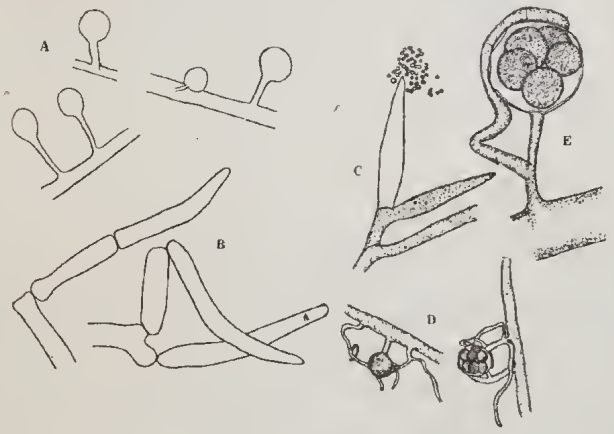

Fig 2.—A, B, *Achlya sp.* ? C-E, *Achlya conspicua* Coker. A. Oogonia. × 33. D, Oogonia with androgynous antheridia. × 33. E, Oogonium with antheridium. × 125.

Achlya oblongata.

de Bary. Bot. Zeit.: 646, pl. 10, figs. 7-9, 1888.

Saprophytic on silver-fish; collected 17th June, 1936; mycelial growth fairly coarse, hyphae up to 90μ diameter; sporangia typical of the genus, but occasionally dictiosporangia occur; zoospores 9–12μ diameter; gemmae frequently formed and are oval or elongated; oogonia very large, oval, pyriform or occasionally spherical, 85–300μ x 70–160μ, borne on lateral branches, terminally on the main hyphae or rarely intercalary; wall of oogonia thin and unpitted; eggs 12–30 per oogonium, fairly small, 23–30μ in diameter, mostly about 26μ, sub-centric, with a sheath of oil droplets all or most of the way around the protoplasm (Fig. 3, C, D); eggs at first dark, becoming lighter in appearance, but rarley maturing; antheridia long, slender, diclinous, usually several wound around each oogonium, tuberous at the point of contact with the oogonium (Fig. 3, A, B).

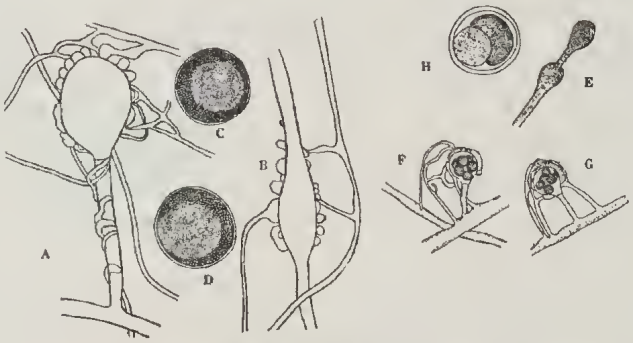

Fig. 3.—A-D, *Achlya oblongata* de Bary. E-H, *Achlya americana* var. *megasperma* nov. var. A, Oogonium with long, diclinous antheridia. × 33. B, Intercalary oogonium with antheridia. × 33. C, Mature oospore with oil globules all around protoplasm globule. × 207. D, Mature oospore with oil globules only partly surrounding protoplasm globule. × 207. E, Gemmae. × 33. F, G, Oogonia with antheridia. × 33. H, Oospore of eccentric type. × 207.

Achlya sp. ?

Saprophytic on *Japonica* fruits, lake at Maryborough, collected 13th February, 1936; growth on hemp seed fairly coarse, hyphae, 15–100μ in diameter; sporangia developed fairly abundantly, producing very small zoospores; gemmae numerous, cylindrical, often very long, terminal ones often tapering to a point, frequently developed in chains along the length of a hypha (Fig. 2, B); oogonia smooth, spherical, 40–75μ in diameter, with a thin, unpitted wall, borne laterally on the hyphae; at first denser in appearance, but rapidly degenerate and lose their contents (Fig. 2, A); eggs never observed; occasionally slender branches were noticed close to oogonia, but as they were never observed to

approach the oogonia, they cannot be regarded as antheridia, and in most cases, there was no sign of antheridial branches near the oogonia.

It is considered that this may be a female strain of a heterothallic species of *Achlya*. Oogonia have been observed in large numbers, when the fungus was grown in various media (an account of these experiments is given earlier in this paper), but they always disorganized without any sign of oospore formation. Heterothallism in the Saprolegniaceae has been reported previously—in *Dictyuchus* by Couch (1926) and for *Achlya* by Coker (1923). Coker states that his heterothallic species—*Achlya bisexualis* n.sp.—is probably the same as one previously described by him in the Saprolegniaceae, as *Achlya* sp., form without oogonia. Our plant differs from *A. bisexualis* in the shape of the gemmae which are always cylindrical, in contrast to the spherical or pear-shaped gemmae of the latter.

Dictyuchus sp.

Saprophytic on rose hips, pond in Botanical Gardens, Melbourne; on *Prunus* twigs in lake in Gardens, at Maryborough, Victoria; the main hyphae are 20–60μ in diameter, tapering towards the end, where they have a diameter range of 18–35μ; sporangia formed at the tips of the hyphae, and lateral ones are formed by cymose branching; in older cultures, the hyphae themselves become segmented into sporangia, often irregular and bent: frequently the sporangia break away from the hyphae bearing them, and are known as resting sporangia. Sporangia developed along the length of a hypha, if the latter is a fine one, may be thread-like, with only a single row of spores; zoospores 11–14μ in diameter, and the spores encyst within the sporangium for a period after which they emerge by individual openings in the sporangium wall, leaving a network of walls in the latter; sexual reproduction not observed.

This isolation agrees in all particulars with *Dictyuchus sterile*. However, Couch has shown that heterothallism is common in the genus *Dictyuchus*, so it is likely also that this may be one strain of a heterothallic form.

Dictyuchus monosporus Leitgeb.

Jahrb. f. Wiss. Bot., 7: 357, pl. 22, figs. 1-12, pl. 23, figs. 1-8, 1869.

Saprophytic on rose hips in lake in Fitzroy Gardens, 20th July, 1935; hyphae fairly coarse, reaching diameter of 60μ; sporangia formed abundantly, in sympodia and also along the length of the hyphae; the method of ejection of the spores is typical of the genus; zoospores 9–15μ in diameter; oogonia terminal on the branches, spherical, 25–35μ in diameter, average 31.5μ, with unpitted walls; oospores borne singly in the oogonia, centric,

smooth, 22–31μ diameter, average 25.7μ; antheridia always developed, usually several in contact with each oogonium, diclinous and encircling the oogonia (Fig. 1, L).

This form agrees in general characters with the type species, except that in our species, the oogonia and oospores are slightly larger. Lund (1934) has described a species agreeing with the one in question except that Lund's form has eccentric eggs. Lindstedt (1872) stated that in *D. monosporus,* the oogonia are 25μ thick, and the sporangia borne only in sympodia, while in *D. Magnusii,* the oogonia are 30–35μ thick, and the sporangia borne only in rows. In this species other sporangia showed both methods of formation, and while the oogonial size is large, similar to that of *D. Magnusii,* it is thought that this form approximates more closely to *D. monosporus,* particularly in the character of the antheridia, which are always found to wrap around the oogonia. Lund (1934) states that *D. monosporus* developed no sexual organs when grown on hemp seed, but the author has obtained them in hemp seed cultures, although they were not observed in the original substrata, namely, rose hips and twigs.

LEPTOMITACEAE.

Sapromyces Reinschii (Schroeter) Fritsch.

Österr. Bot. Zeitschr. 43, p. 420, 1893.

Saprophytic on rose hips and apples in lake at University; collected 5th April, 1935; saprophytic on apples in Barham River, near Apollo Bay, collected 1st June, 1936. This form was found in abundance, and was frequetnly associated with *Gonapodya* and *Blastocladia.* While *Blastocladia* produces a short compact tuft, on the fruits, tufts containing *Sapromyces* alone were not so dense, and projected further from the fruits.

Plant attached to substratum by well-developed rhizoids, the rhizoidal system being often very extensive; basal cell including the rhizoids, varies from 300–1200μ in length and 15–30μ in breadth, and produces distally finer branches which are cylindrical, segmented and 8–15μ in diameter (Fig. 4, A); reproductive organs arise from these branches or from the finer filaments which arise from them; constrictions between the segments usually closed with cellulin plugs; asexual reproduction by zoosporangia borne singly or usually in groups of 2–5 at the end of the filaments or at the constrictions. Zoosporangia 40–170μ x 15–30μ elongate and usually wider about the middle than at either end; zoospores escape by a terminal pore or occasionally germinate inside the sporangium. The method of escape mentioned by Kanouse (1927), in which the whole zoospore mass emerged, surrounded by a membrane which is immediately ruptured, was also observed; sexual reproduction not always

present in the material examined, but if present at all was abundant; oogonia borne terminally or laterally, and often associated with sporangia in the same whorl; oogonia 41–63μ x 29–40μ pyriform to sub-spherical, with a well-developed pedicel. When mature the oogonial walls are covered with a yellowish-brown incrustation which is usually thicker at the apex, and a single spherical oospore is developed within each oogonium; oospores vary in size from 26–34μ, wall fairly thick, brown externally but colourless when viewed in optical section, occasionally slightly irregular, but the series of irregular ridges noted by Sparrow (1936), were not visible; antheridia always present and usually of diclinous origin; swollen and clavate in shape, 30–40μ x 9–13μ, borne on long, winding, twisted branches, 4–6μ in diameter, and send a prominent fertilization tube into the oogonium (Fig. 4, B). One example was found of an androgynous antheridium said to be characteristic of *S. androgynous*. On the same plant there were numerous oogonia fertilized by antheridia from different plants, and therefore of diclinous origin (Fig. 4, C). This is interesting, in view of the fact that Sparrow (1932) mentions that experiments were being carried out by P. H. Jordan which seemed to indicate that this

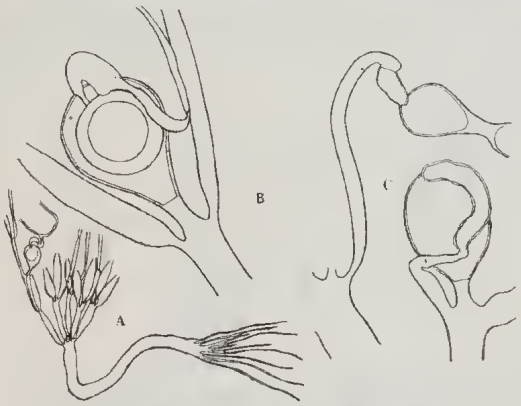

Fig. 4.—*Sapromyces Reinschii* (Schröeter) Fritsch. A, Plant showing well developed rhizoidal system and bearing reproductive organs. × 33. B, Oogonium with diclinous antheridium. × 207. C, Two oogonia from the same plant, one with diclinous antheridium, the other with androgynous antheridium. × 207.

species is heterothallic. It has also been noted that a well-developed rhizoidal system is present, as previous workers have suggested that they are not developed. Sparrow (1932) stated that the narrow basal cell is "presumably anchored by hold-fasts," but in all the plants examined in this collection except those that were obviously broken above the point of attachment of the substratum, rhizoids were present (see Plate X., 7, 8).

RHIPIDIUM AMERICANUM Thaxter.

Bot. Gaz., 21: 320, pl. 22, figs. 1-15, 1896.

Saprophytic on rose hips, in Lake at University, 5th April, 1935; on apples, *Japonica* fruits, *Cotoneaster* berries, in lake in Maryborough Gardens; plant attached to substratum by means of rhizoids, sometimes copious, at other times scanty; basal cell peltate, 180–300μ from rhizoids to apex, and in surface view, the apex has an irregularly stellate appearance (Plate X. 6); stalk varies in diameter from 23–50μ, and at the top may divide dichotomously to form branches or lobes which spread in a radiate fashion, or may expand into a flattened head which is lobed or branched around its circumference (Fig. 5, A, B); diameter of the apex varies from 90–250μ, and has a fairly thick wall 3–7μ, but the diameter of the individual lobes range from 10μ–90μ. From this basal cell arise filamentous branches 150–700μ x 3–10μ, and they are swollen just above their attachement to the thallus. These filaments are usually segmented, resembling the filaments of *Sapromyces Reinschii*. Zoosporangia borne terminally on the filaments, usually 2 or 3 together, less often singly, ovoid, 46–100μ x 16–40μ (Fig. 5, C, D); zoospores observed to emerge in a cylindrical mass surrounded by a thin membrane which ruptures and allows the zoospores to escape; sexual reproduction not observed, although a large number of plants were examined.

FIG. 5.—*Rhipidium americanum* Thaxter. A, B, Peltate thalli showing irregular branching. × 33. C, Sporangia occurring singly, or in twos or threes. × 33. D, Sporangia. × 125. E, Portion of thallus showing thick walls, and the basal parts of filaments. × 207.

The nature of the thallus, although constant in form, in the plants examined here, is very varied as shown by the descriptions of other workers. Forbes (1935) describes plants in which the basal part is cylindrical and branched, resembling the thalli of some *Blastocladias*. Sparrow has described *Rhipidium americanum* showing examples of both the peltate thalli and the branched tree-like plants. Since the sporangial measurements are similar to those of plants described in other collections it is

likely that *Rhipidium americanum* is a species like *Blastocladia Pringsheimii* in which the thallus is extremely variable in size and shape.

Pythium proliferum de Bary.

Pringsh. Jahrb. Wiss. Bot. 2, p. 182, 1860.

Saprophytic on twigs, in lake at University grounds; collected 5th April, 1935; mycelium delicate, hyphae of uniform diameter, varying from 2–5μ; a few bud-like projections from the hyphae are sometimes found, but are not characteristic as in *Pythiomorpha gonapodioides*; sporangia developed in water cultures, spherical to pyriform in shape with a very long papilla; at maturity, they measure 26–46μ x 20–32μ (Fig. 6, F); proliferations occur, the secondary sporangia being formed inside the old one, or the hypha may grow through it and form the new sporangium at some distance further on; sporangia frequently function as conidia producing germ-tubes, but they also were observed to produce zoospores in the true *Pythium* fashion—that is, the protoplasm is

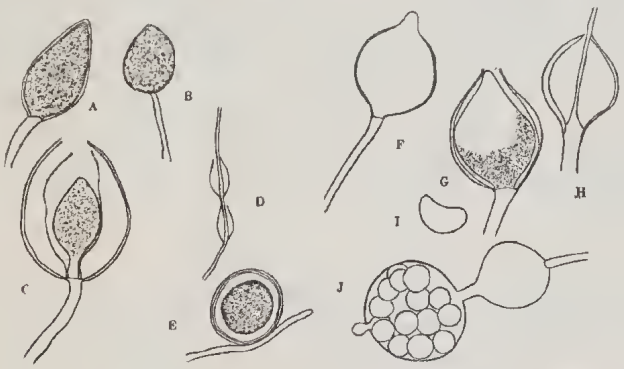

Fig. 6.—A-E, *Pythiomorpha gonapodioides* Petersen. F-H, *Pythium proliferum* de Bary. A, B, Young sporangia. × 207. C, Proliferating sporangia. × 207. D, Empty sporangia with the hypha growing through. × 33. E, Oogonium with thick three-layered wall. × 207. F, Sporangium with papilla. G, Proliferating sporangia. A, Empty sporangium through which hypha has grown. I, Zoospore. J, Sporangium with vesicle. All × 207.

extended into a vesicle where the zoospores are differentiated (Fig. 6, J); in one case observed, 30 minutes elapsed from the time the vesicle was formed until the zoospores were set free; in the vesicle they are spherical, and, appear to escape at a thin point in the wall, they were constricted as they passed through, and assumed a reniform shape in the swimming stage, but settling down, they became spherical again; no sexual organs observed.

PYTHIOMORPHA GONAPODIOIDES H. E. Petersen.

Bot. Tidsskr. 29, p. 391, figs. VI. and VII., 1909; and in Ann. Myc. 8, p. 528, figs. VI. and VII., 1910.

Saprophytic on rose hips in pond in Fitzroy Gardens, collected 20th July, 1935; on grapes, prunes, and rose hips in pond in Botanical Gardens, collected 23rd May, 1935; on oranges in McCallum's Creek, near Maryborough, collected 12th February, 1936. In the case of the grapes, the pond water was brought into the laboratory and baited with the fruit. Hyphae irregular in appearance, owing to the fact that a single hypha may vary in diameter from 2–8μ; bud-like projections are frequently developed on the mycelium; sporangiophores of uniform diameter, slightly narrower than the ordinary hyphae; sporangia pyriform, papillate and proliferate frequently, the new sporangium formed within an old one or at some distance beyond it, and frequently a row of sporangia is developed (Fig. 6, D); range in size from 40–70μ x 20–40μ. Sporangia set free zoospores without the formation of a vesicle; zoospores—spherical, 9–13μ diameter, usually more than 20 per sporangium; sporangia were present on the mycelium on the fruit and hips when brought in; oogonia spherical, 23–28μ diameter, and when mature have a thick three-layered wall (Fig. 6, E); oospores yellowish in colour and 20–22μ diameter. Only one antheridium was noted, and this was clavate in shape and of diclinous origin.

This form agrees in all particulars with *Pythiomorpha gonapodioides* except in the size of the sporangia which are slightly larger in our form.

BLASTOCLADIALES.

Blastocladiaceae.

GONAPODYA SILIQUAEFORMIS (Reinsch) Thaxter.

Bot. Gaz., 20: 480, pl. 31, figs. 6-10, 1895.

Saprophytic on rose hips and twigs in pond at University, and on rose hips again in pond at the Fitzroy Gardens; pustules on the fruit differed from those of Blastocladia in forming loose spreading mats of hyphae, in contrast to the short dense tufts of the *Blastocladias;* vegetative plant attached by scanty rhizoids, consists of hyphae more or less sparingly branched in the lower parts, but more copiously branched in the upper parts, giving a successively umbellate appearance; whole plant segmented, each constriction corresponding to a pseudo-septum formed by a deposit of cellulin; sometimes segmentation is almost entirely absent (Fig. 7, D), although the cellulin plugs may be present; in the basal parts, the segments are long and narrow but in the upper part short and rounded; sporangia, 60–220 x 15–35μ, pod-shaped, frequently proliferating (Fig. 7, C, D), borne terminally on the hyphae or in umbels sometimes separated by a definite

constriction; zoospores numerous, hyaline with conspicuous nuclei and weak granular forward end, one backward moving cilium; sexual reproduction not observed.

Gonapodya polymorpha Thaxter.

Bot. Gaz., 20: 481, pl. 31, figs. 11-16, 1895.

Saprophytic on *Japonica* fruits in lake at Maryborough Gardens; vegetative plant consists of more slender hyphae in which segmentation is not pronounced, which give rise to tufted umbellate branches composed of oval or irregular segments; sporangia borne terminally on the segments, one to three arising from each segment, rather oval in shape, and truncate at the apex after dehiscence, size 85–110μ x 35–45μ; sexual organs not observed. The habit of this plant strongly resembles that of

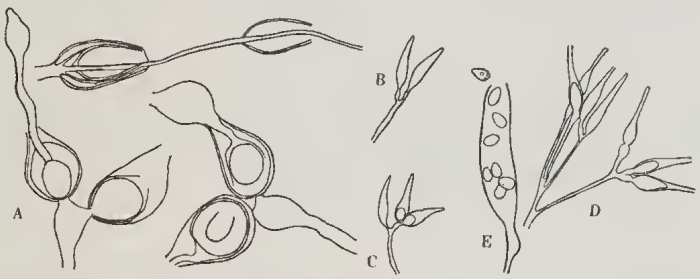

Fig. 7.—A, *Gonapodya polymorpha* Thaxter. Filaments with proliferating sporangia. × 207. B-E, *Gonapodya siliquaeformis* Reinsch. B, Young sporangia. × 33. C, D, Sporangia showing early stages in proliferation. × 33. E, Zoosporangium with zoospores. × 150.

G. polymorpha, but the size of the sporangia is definitely larger. However, the appearance is so similar to *G. polymorpha,* that it must be regarded as that species, in which the sporangia are larger, possibly, due to different environmental conditions.

Blastocladia (Reinsch) Emend.

Pringsh. Jahrb. Wiss. Bot. 2, p. 182, 1860.

Plant consists of large basal cell of very variable form, short and swollen, or long, cylindrical, branched or unbranched, the apices of the trunk or lobes often expanded; plant attached to substratum by rhizoids; filamentous hairs, simple or branched, often arise from the basal cell on its branches, and these hairs have a bulbous base; zoosporangia sessile on the basal cell, variable in size and shape; zoospores numerous, usually uniciliate, emerging through a terminal pore; resting spores sessile like the sporangia, usually oval or spherical in shape; antheridia have been observed in one species by Kanouse (1927), who concludes that the "resting-spores" should really be regarded as oogonia.

Up to the present, ten species of *Blastocladia* have been described, and a new species is given here, namely *Blastocladia aspergilloides* n.sp.

Key to the Species.

A. Basal cell swollen or cylindrical with swollen heads, branched or unbranched	B
Basal cell cylindrical, usually much branched, the apex of the thallus or its branches not swollen ..	E
B. Basal cell globose, slightly narrowed towards base, sporangia 55–130 x 16–40μ	*B. globosa*
Basal cell cylindrical in the lower part, with swollen heads; thallus branched or unbranched ..	C
C. Plants 140–260μ, basal cell unbranched, sporangia long, narrow, cylindrical, 85–150μ x 8–15μ ..	*B. aspergilloides* n.sp.
Plants usually larger, branched or unbranched, sporangia ovate or broadly cylindrical	D
D. Sporangia proliferating	*B. prolifera*
Sporangia not proliferating ..	*B. Pringsheimii*
E. Plants tall, 600–950μ x 20–45μ, branched, hyaline; sporangia borne in a racemose or corymbose manner, 120–220μ x 22–34μ ..	*B. gracilis*
Plants smaller, sporangia on the apex of the thallus or its branches ..	F
F. Sporangia long, narrow, cylindrical, 60–210μ x 8–25μ	*B. augusta*
Sporangia broadly cylindrical or oval	G
G. Plant very hyaline, sporangia oval, 27–40μ x 7–13μ, not proliferating	*B. ramosa*
Plant dark in colour, sporangia broadly cylindrical, not narrowed at base, proliferating, 80–140μ x 18–35μ	*B. prolifera*

Blastocladia Pringsheimii Reinsch.

Jahrb. Wiss. Bot. 11: 298, 1878.
Emend. Thaxter, Bot. Gaz. 21: 51, 1896.

Saprophytic on rose hips, lake at University, 5th April, 1935, Botanic Gardens, 23rd April, 1935; Fitzroy Gardens, 20th July, 1935; on banana, Yarra River, Rudder Grange, 10th November,

1935; on apples, *Japonica* fruits, winter-cherry fruits, lake at Maryborough Gardens, 13th February, 1936; *Cotoneaster* berries, *Japonica* fruits, McCallum's Creek, Maryborough, 12th February, 1936; on apples, Barham River, Apollo Bay, 1st June, 1936.

This form is an extremely common saprophyte on any decaying fruits, but was never found on twigs of any kind; the pustules of *Blastocladia Pringsheimii* were dense, tufted, up to 1 mm. in diameter, and yellowish white in colour. There were usually a large number of individuals in a pustule, and although occasionally a pustule is composed entirely of plants of the one species, usually *B. Pringsheimii* was associated with other forms, e.g., *Rhipidium,* or other *Blastocladia* sp., but not with the filamentous fungi, e.g., *Saprolegnia, Achlya.*

Plant consists of a large basal cell attached to the substratum by rhizoids, and very variable in size and shape; figure 8 shows the variations in the thallus of *B. Pringsheimii* from material obtained from different sources; basal cell may be fairly short, unbranched and swollen towards the apex, or long cylindrical, branched or unbranched, the distal part of the trunks or of the lobes being rather swollen; on the expanded region the sessile sporangia are borne, together with filamentous hairs, simple or branched and with a bulbous base; sporangia more or less long,

FIG. 8.—*Blastocladia Pringsheimii* Reinsch. Plants showing varying size and shape of basal cell and sporangia. ×25.

cylindrical, ranging in size from 70–280μ x 14–70μ over a large number of plants; zoospores numerous, 12–15μ in diameter, escaping directly through the terminal pore; the formation of a vesicle described by Von Minden (1916) and Sparrow (1932) was not observed; zoospore discharge seems to be largely influenced by external conditions, as in most of the sporangia observed, the zoospores did not escape but disintegrated within

the sporangium; resting spores frequently found, and always associated with the sporangia, oval or spherical, thick-walled, punctate and 40–99μ x 30–50μ.

As suggested by Sparrow (1936), *B. Pringsheimii* appears to be a very variable form, both in the nature of the thallus, and in the size of the sporangia. In practically each locality, whence this form was obtained, the habit varied, as also did the range in sporangial size, giving from all the plants examined, a wide range of 70–280μ x 40–70μ, although in individual plants the range was not of this order. From the measurements of the length and breadth of the sporangia in 265 individuals, frequency

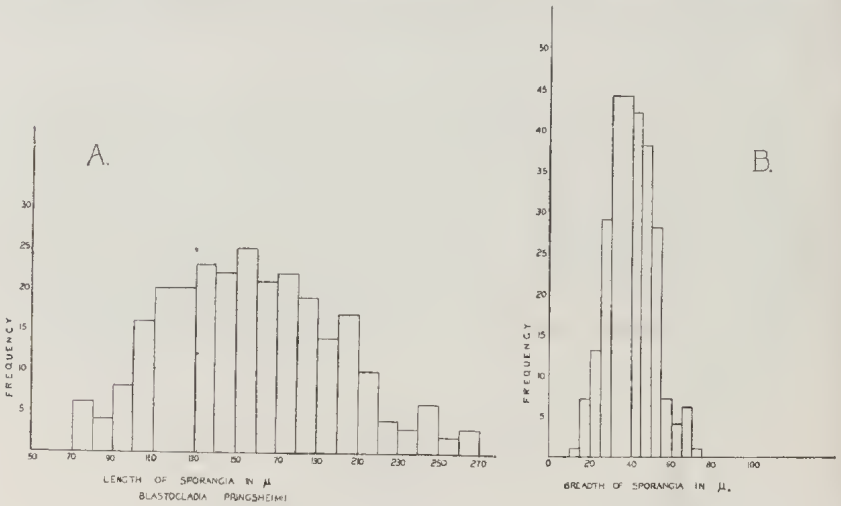

Fig. 9.—*Blastocladia Pringsheimii.* Frequency diagrams to illustrate variation in length (A) and breadth (B) of sporangia.

column diagrams have been prepared and from these the maximum frequency in length and breadth can be noted. In the length diagram, the lengths are arranged in classes with an interval of 10, e.g., 70–79.9, 80–89.9, etc. Thus there are 25 individuals (sporangia) with a length between 150 and 159.9, which class shows the greatest frequency, 21 individuals with length between 160 and 169.9, etc. In the diagram illustrating breadth (Fig. 9, B) a measurement which is not as variable as the length, and hence shows a greater frequency in the classes (since the same number of individuals were measured in both cases) the breadths are arranged in classes with an interval of 5, e.g., 10–14.9, 15–19.9, etc. This method was used here instead of classes with an interval of 10, only for greater convenience in preparing the diagram, owing to the greater frequencies shown in the classes, e.g., between 30–34.9, there is a frequency of 44, between 35–39.9, a frequency of 44 also, hence between 30–39.9 a frequency of 80 (which would be difficult to express with the scale in use), which is the maximum frequency. Although these

forms appear widely different in size, habit, etc., there does not at present seem to be sufficient justification to separate them as other species, particularly on the basis of measurements. Size is a very variable character, particularly when studied over a large number of individuals, and may be influenced by external conditions, e.g., amount of food material present, etc.

Blastocladia prolifera von Minden.

Kryptogamenfl. Mark Brandenburg, 5: 606, 1912.

Saprophytic on rose hips, lake at University, collected 5th April, 1935; Saprophytic on apples and *Japonica* fruits, lake at Maryborough, collected 13th February, 1936; this species was found in pustules and was sometimes associated with *Blastocladia Pringsheimii* or with *Gonapodya*. In the first collection obtained of this form, on rose hips, the plants were a dark bluish-black colour and this was also characteristic of the *B. Pringsheimii* plants associated with it. In a later collection from a different locality, the plants of *B. prolifera* were not striking in colour at all, only tinged with brown, and *B. Pringsheimii* when found in other parts, and on rose hips again, did not have this bluish-black colour, although plants of the latter are often dark brown in colour. The cause of this unusual colour is not known.

Plant attached to substratum by rhizoids; basal cell cylindrical in the lower part, about 150–300μ x 50–70μ but irregularly and copiously branched in the upper parts, the branches often only 10μ in diameter; sterile hairs were seldom present; sporangia sessile on the branches, cylindrical, often curved, rounded at the apex; but truncate at the base, 80–140μ x 18–35μ, proliferating by successive sporangia formed inside the old ones; resting spores

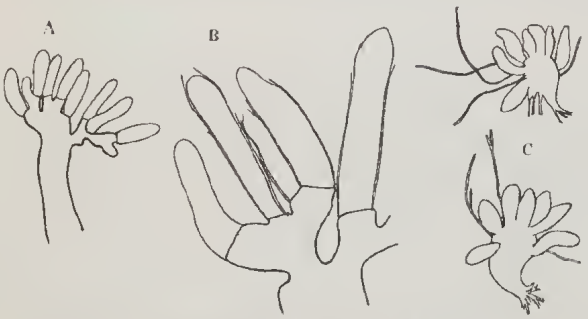

Fig. 10.—A, B, *Blastocladia prolifera* von Minden. A, Young plant showing irregular branching and sessile sporangia. × 100. B, Portion of thallus showing proliferating sporangia. × 270. C, *Blastocladia globosa* Kanouse. Plants bearing sporangia and sterile hairs. × 100.

not observed: the plants, generally, are smaller than those of *B. Pringsheimii,* and the lobes or branches are not swollen at the apex as in *B. Pringsheimii* except in one or two cases.

Sparrow (1936) figures plants of *B. prolifera* in which the heads are definitely rounded. In the plants examined here the sporangia were often so densly crowded around the top of the plant, that the nature of the sporangia could not be seen, but it gave the appearance of a head similar to that of *B. Pringsheimii.* When the plants were dissected the crowded, irregular branching were observed. Proliferating sporangia were abundant in the older plants.

BLASTOCLADIA GRACILIS Kanouse.
Amer. Jour. Bot., 14, p. 300, pl. 33, figs. 14-16, 1927.
BLASTOCLADIA RAMOSA var. LUXURIANS Kanouse.
Michigan Acad. Sci. Arts and Letters: 105, pl. 1, fig. 1.

Saprophytic on apples, rose hips, and banana, Yarra River at Rudder Grange, collected 10th November, 1935. This species occurred in the same pustules as *Blastocladia* n.sp., *Blastocladia gracilis,* and *Gonapodya siliquaeformis.* Plant attached to substratum by weakly-developed rhizoids, whole plant 600–950μ in length; basal cell cylindrical, slender, about 20–45μ in diameter, branched in a racemose to sub-dichotomous manner, hyaline, smooth, wall thin—2-4μ. Sterile hairs with bulbous base noted on some plants (Plate X., 3); zoosporangia borne in a racemose or corymbose fashion, long cylindrical, 120–220μ x 23–34μ (Fig. 11, A); resting spores usually terminal on the branches, oval to spherical with a truncate base, 45–60μ x 25–40μ (Fig. 11, B). This plant is very similar to the species described by Kanouse, except in the slightly larger size of the sporangia and the presence of sterile hairs on some plants, also the plants are sometimes more branched than Kanouse suggests—a feature also observed by Lund (1934).

BLASTOCLADIA RAMOSA Thaxter.
Bot. Gaz. 21, 50, pl. 3, figs. 14-16, 1896.

Saprophytic on banana fruits, Yarra River at Rudder Grange, collected 10th November, 1935; this fungus occurred in pustules associated with *Blastocladia gracilis;* plant attached to substratum by poorly developed rhizoids, whole plant 500–700μ in length; basal cell cylindrical, 15–33μ in diameter, copiously and irregularly branched in the upper parts, the finer branches which bear the reproductive organs terminally, having a diameter of only 5–14μ; wall thin, smooth, hyaline, the whole plant having a very delicate appearance; zoosporangia oval, slightly narrowed towards the base, 27–40μ x 7–13μ; resting spores bluntly rounded at the apex, narrowing towards the base, 18–25μ x 11–13μ (Fig. 11, I).

The plants seem to be taller than those described by Thaxter, but from its delicate appearance, and small size of the sporangia and resting spores, it is unmistakably *B. ramosa.* The size of the

sporangia and resting spores agrees fairly well with those of Thaxter, 1896A) and of Sparrow (1932), but differs greatly from those of another collection described by Sparrow recently, in which the reproductive organs are much larger.

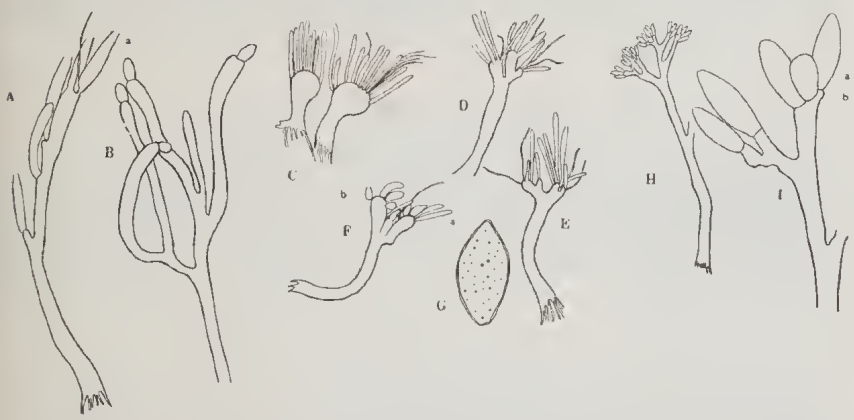

FIG. 11.—A, B, *Blastocladia gracilis*. C, *Blastocladia aspergillioides* n. sp. D-G, *Blastocladia augusta* Lund. H, I, *Blastocladia ramosa* Thaxter. A, Plants with sporangia (*a*) × 30. B, Plants with resting spores (*b*) × 30. C, Plants with sporangia × 30. D, E, F, Plants bearing sporangia (*a*) and resting spores (*b*) × 30. G, Resting spore. × 205. H, Portion of plant with sporangia. × 90. I, Part of plant showing sporangia (*a*) and resting spores (*b*) × 205.

BLASTOCLADIA AUGUSTA A. Lund.

Memoires de l'Acad. Roy. des Sc. and Lett. de Danemark, Copenhague, p. 44, fig. 21, 1934.

Saprophytic on rose hips, lake at University, collected 5th April, 1935; on rose hips in lake at Botanic Gardens, collected 23rd May, 1935; the small whitish pustules in which this form was found consisted either entirely of this species or occasionally contained a few plants of *B. Pringsheimii*.

Plant attached to substratum by thin branching rhizoids, often copiously developed; whole plant very delicate and hyaline, but in a few plants observed, the contents were quite brownish; plants 160–500μ high; basal cell slender, cylindrical, 10–35μ in diameter and usually branched in the upper parts—occasionally unbranched plants are obtained. The tips of the branches on which the reproductive organs are borne are not swollen and globose as in *B. Pringsheimii*, although sometimes they gradually increase in diameter towards the tip. Sterile hairs usually present (Plate X., 5, Figs. 11 D–F); sporangia long cylindrical, narrow, 60–210μ x 8–25μ; resting spores oval, light coloured, usually narrowed towards the tip; apex of spores rounded or sometimes beaked (Fig. 11, G); resting spores thin-walled, and sometimes a suggestion of a pitted inner wall is obtained; size 25–45μ x 16–26μ.

In their light colour and thin outer wall, these spores resemble those of *B. ramosa*, which, according to Thaxter (1896A), may properly be spoken of as conidia. Although most of the plants

showed only the sporangial stage, a few were obtained in which resting spores were present, and these have not been observed previously. They appear to resemble those described for *B. rostrata* (Minden 1912) but the latter, although not examined by the author, appears to be a larger plant, differing in habit, with fusiform sporangia, in contrast to the narrow, cylindrical ones of this species.

Blastocladia globosa Kanouse.

Amer. Jour. of Botany, vol. XIV., p. 298, pl. XXXII., figs. 1-4, 1927.

Saprophytic on berries of *Solanum pseudo-capsicum*, lake at Maryborough, collected 13th February, 1936; plants occurred in very small, dense, whitish pustules, sometimes associated with *Gonapodya siliquaeformis* but more often alone; plant attached to substratum by a few rhizoids, not as extensively developed as in *B. Pringsheimii* (Fig. 10, C); basal cell globose to sub-globose usually narrowed towards base, sometimes lobed, the lobes being very swollen; plants 120–200μ high and up to 200μ in diameter, the narrow part from which the rhizoids develop having a diameter of 30–50μ; wall fairly thick and laminate, protoplasm dark brownish. Sterile hairs usually present, simple or branched; sporangia sessile, broadly cylindrical, 55–130μ x 16–40μ (Plate X., 2); resting spores oval to spherical, 25–35 x 27–32μ and are dark with a thick pitted wall.

The antheridial filaments described by Kanouse were not observed. The habit of this plant strongly suggests *B. globosa*, but the size of the sporangia, and in a greater degree, that of the resting spores, is smaller than those described by Kanouse, and also by Sparrow (1936).

Blastocladia aspergilloides n.sp.

Saprophytic on rose hips, lake at University, collected 5th April, 1935; on apples at Yarra River, Rudder Grange, collected 10th November, 1935; plants occurred in small, whitish pustules, either alone or associated with *B. gracilis*.

Plant attached to substratum by means of a few fairly stout rhizoids—up to 5μ in diameter; plant consists of a single cell, cylindrical in the lower part 25–45μ in diameter, but expanded at the apex to form a swollen head—60–85μ in diameter (Plate X., 1, 2, Fig. 11 C); branched forms were not observed; plants 140–200μ high, dark in colour due to dark brown protoplasm, wall of basal cell fairly thick, 3.5–5μ; sterile hairs usually present, only 1–2μ in diameter; sporangia long, narrow, cylindrical, arising from the swollen head, 85–150 x 8–15μ. Zoospores emerge through a terminal opening; resting spores not observed.

The species is characterized by its unbranched basal cell with a swollen head bearing long thin sporangia, the whole plant having a dark brown colour. The sporangia in form and size

are similar to those of *B. augusta* Lund., although slightly narrower, but the latter species has a branched basal cell usually, the branches not being swollen at the apex, and the whole plant is delicate and hyaline in appearance. Both species were found on the same fruit but not in the same pustule.

Latin description :—

BLASTOCLADIA ASPERGILLOIDES (n.sp.).

Planta paucis filamentis rhizoideis crassis substrato affixa; cellula basali simplici, parte inferiore cylindrica diametro 25–45μ, capite inflato, diametro 60–85μ; altitudine 140–260μ, colore atrofusco, muris cellulae 3.5–5μ crassis. Adsunt plerumque capilli steriles diametro 1–2μ. Sporangia longa angusta cylindrica 85–150μ x 8–15μ. Oosporae ignotae.

Summary.

1. Aquatic fungi have been collected from different localities. The methods of collection were those recommended by other workers—placing traps containing baits in the ponds or streams, although additional baits have been used.

After four to six weeks, the baits were brought into the laboratory, examined, and when possible, pure cultures of the fungi were obtained.

2. Twenty species were examined, only one of which, namely, *Saprolegnia ferax*, has previously been described from Australia.

3. An account is given of the systematic and physiological characteristics of these species, including experiments regarding the formation of the sexual organs in various media.

4. The species recorded are:—

Saprolegnia ferax (Gruith) Thuret.,
Achlya conspicua Coker,
Achlya americana var. *megasperma* var. nov.,
Achlya oblongata de Bary,
Achlya sp. ?,
Dictyuchus sp.,
Dictyuchus monosporus Leitgeb.,
Pythium proliferum de Bary,
Pythiomorpha gonapodioides H. E. Petersen,
Sapromyces Reinshii (Schroeter) Fritsch.,
Rhipidium americanum Thaxter,
Gonapodya siliquaeformis (Reinsch.) Thaxter,
Gonapodya polymorpha Thaxter,
Blastocladia Pringsheimii Reinsch,

Blastocladia prolifera Von Minden,
Blastocladia gracilis Kanouse,
Blastocladia ramosa Thaxter,
Blastocladia augusta A. Lund,
Blastocladia globosa Kanouse,
Blastocladia aspergilloides n.sp.

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Explanation of Plates.

Fig. 1.—*Blastocladia aspergilloides* n. sp. Two plants with sporangia. × 150.

Fig. 2.—*Blastocladia globosa* Kanouse. Plant showing swollen basal-cell with rhizoidal system and sporangia. × 450.

Fig. 3.—*Blastocladia gracilis* Kanouse. Thallus with sporangia. × 100.

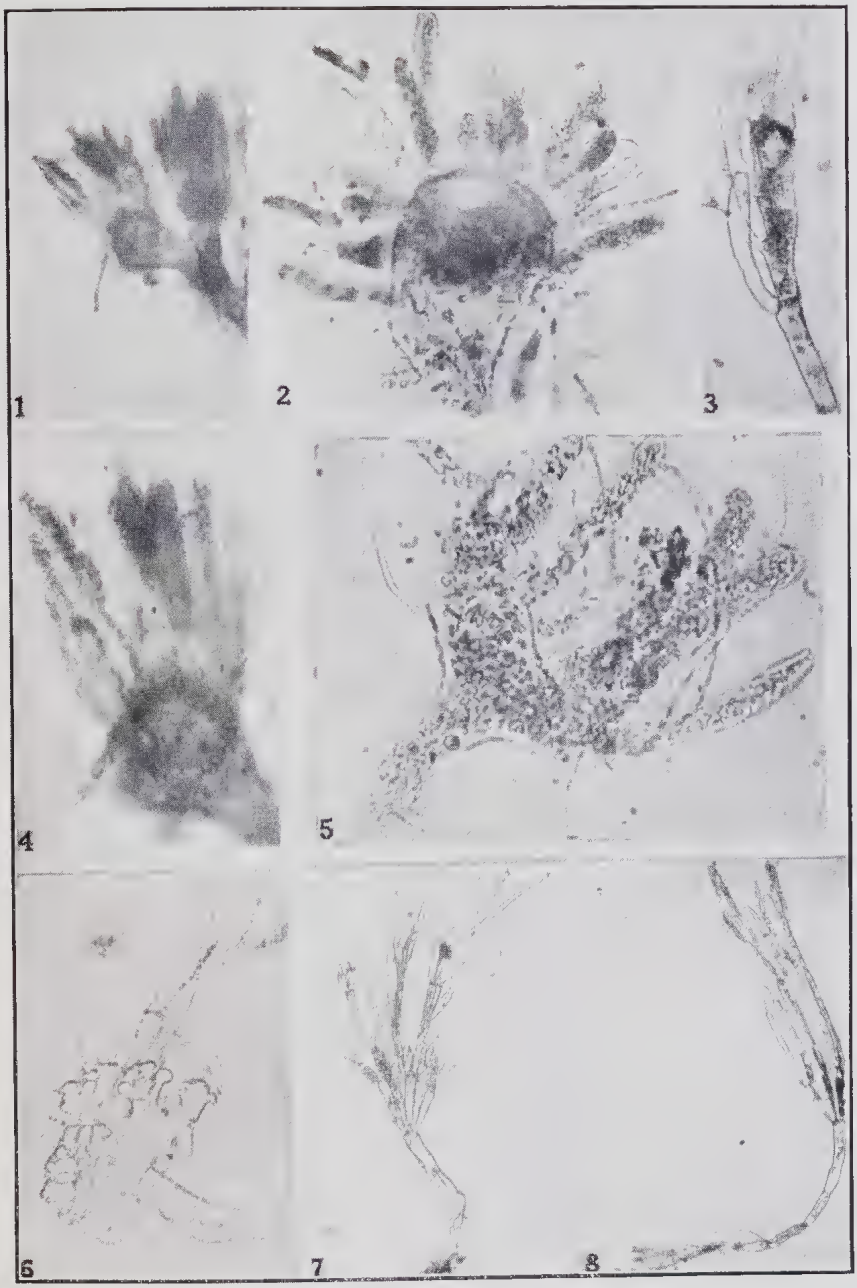
Fig. 4.—*Blastocladia aspergilloides* n. sp. Apex of thallus showing swollen head with sporangia. × 620.

Fig. 5.—*Blastocladia angusta* Lund. Upper part of thallus showing branches —not swollen at the apex. × 620.

Fig. 6.—*Rhipidium americanum* Thaxter. Thallus bearing filaments. × 450.

Figs. 7, 8.—*Sapromyces Reinschii* (Schröeter) Fritsch. Plants with sporangia. × 100.

* These papers were not obtainable for reference.



Aquatic Phycomycetes.